

# Industrial DG Market Transformation Tools

CONFIDENTIAL/DOE

## Industrial DG Market Transformation Tools: DG/CHP Operational Reliability and Availability Database

Paul J. Baubela

ORNL Technical Project Officer - Patti Garland  
Distributed Energy and Electric Reliability Programs  
January 21-23, 2003  
Washington, DC



## DG Operational Reliability and Availability Database

### Technical Approach

- OR performance
  - data base must address diverse prime mover technologies and applications
  - affected by design, installation, application, and O&M practices
  - data available from industry sources should be used where appropriate
  - statistics must be based on a meaningful sample size
- Procedures for collecting, processing, and analyzing data must be tightly controlled

EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG/CHP Operational Reliability and Availability Database

- Establish baseline operating and reliability data for industrial and commercial distributed generation and combined heat and power systems
  - DG/CHP systems reliability and availability is a critical element in market development
- Data from maintenance logs, operation records, and other available sources
  - Enhance collection of data from a representative sample of existing facilities
  - Methodology is based on actual customer data
    - Dependent on customer participation
    - Customer-based process creates better understanding of DG operations
  - Allows substantial prior work by others on evaluating create power system reliability
- Identify and classify DG/CHP system failures and outages

EIS/EA ENVIRONMENTAL ANALYSIS INC.

## Operational Reliability and Availability Database Benefits

- Deliverables will be a database of operational reliability data for DG systems
  - Current DG/CHP facility managers better understand reliability and availability performance
  - This is a key metric for market development
  - Determine how facilities compare with other DG resources
  - Availability and downtime impacts
- Potential DG/CHP users make more informed purchase decisions
  - System reliability impacts
  - Availability and downtime impacts
  - Policy makers quantify potential benefits of customized DG/CHP
    - Standby and back power components of assets
  - System reliability impacts

EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG Operational Reliability and Availability Database

### Database Content

- Plant Configuration
- Unit Operations
  - Operations data for each unit
- Event Description
  - History of planned and unplanned outages
- Reports
  - Unit Operations and Event Description
  - Summary OR statistics for a unit, duty cycle and technology
- Facility sites, manufacturers and models are anonymous

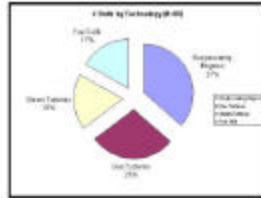
EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG Operational Reliability and Availability Database Project Results

- Data collected on 49 sites representing 88 units for 2000-2001 time frame
  - 200 outage events
  - >300,000 unit-hours of operation
- Breakdown by prime mover technology and duty cycle (peak, cycling, baseload)
- Unit specific data indicate that units (in all technology groups) used in higher and continuous duty applications have similar failure rates
- Period based failure rates for standby units are much lower due to the low utilization of these units that provide fewer opportunities for failures to occur
- Entire Sample Results
  - 7.9% Average Availability Factor
  - 7.9% Average Average Outage Factor
  - 2.5% Average Scheduled Outage Factor
  - 87.60% Average Service Factor

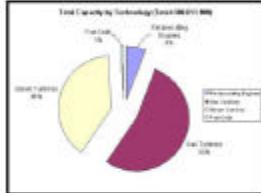
EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG Operational Reliability and Availability Database Project Results



EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG Operational Reliability and Availability Database Project Results



EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG Operational Reliability and Availability Database Project Results

Technology	N	Avg. Outage Factor		Avg. Rel. Factor		Avg. Sched. Outage Factor		Avg. Service Factor	
		Mins	hrs	Mins	hrs	Mins	hrs	Mins	hrs
Natural Gas	46	35.36	1.88	30.00	0.91	30.00	0.91	46.60	1.16
Diesel	7	31.61	0.81	31.00	0.85	24.00	0.74	33.86	0.86
Coal/Turbine	6	80.90	2.02	66.00	1.81	56.00	1.56	73.00	1.93
Other	12	48.75	1.30	44.00	1.21	38.00	1.08	50.00	1.33
Nuclear	1	4.62	0.01	4.00	0.01	4.00	0.01	4.62	0.01
Total	71	34.12	0.90	30.76	0.88	32.00	0.89	44.36	1.13
Mean	1	4.87	0.01	4.40	0.01	4.57	0.01	4.87	0.01

EIS/EA ENVIRONMENTAL ANALYSIS INC.

EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG Operational Reliability and Availability Database Project Results

Duty/Cycle	SP Range	N	Avg. AF Mins	Avg. AF hrs	Avg. RF Mins	Avg. RF hrs	Avg. Sched. Outage Factor	Avg. Sched. Hrs	Avg. SF Mins	Avg. SF hrs
Peak	<10%	52	21.43	0.54	28.00	0.75	27.00	0.68	22.35	0.53
Cycling	10-20%	20	31.00	0.80	31.00	0.81	29.50	0.73	26.25	0.63
Baseload	>20%	30	15.17	0.38	21.00	0.53	17.00	0.42	15.33	0.38
Other	>100%	36	31.00	0.80	31.00	0.81	29.50	0.73	26.25	0.63

EIS/EA ENVIRONMENTAL ANALYSIS INC.

## DG/CHP Operational Reliability and Availability Database Project Significance

- First attempt to establish a baseline operating and reliability data for DG/CHP systems in more than a decade
  - Reliability and availability is a critical element in market development
- Based on actual customer operating data and experience
  - Data from maintenance logs, operation records, and other available sources
  - Representative collection of data from a representative sample of operating facilities
  - Methodology is based on actual customer data
    - Dependent on customer participation
    - Customer-based process creates better understanding of DG operations
  - Allows current and potential users benchmark reliability
    - Data is only for 2000-2001 time period
      - Updating and reanalysis on a regular basis will ensure continued usefulness

EIS/EA ENVIRONMENTAL ANALYSIS INC.

## Work Scope to Complete

- Beta Version of DB submitted
- Reporting
  - Draft final report for comments
  - Final Report

EIS/EA ENVIRONMENTAL ANALYSIS INC.